YASHIL
IQTISODIYOT&TARAQQIYOT

Ijtimoiy, iqtisodiy, texnologik, ilmiy, ommabop jurnal

GREEN ECONOMY AND DEVELOPMENT

Social, Economic, Technological, Scientific and Popular Science Journal

2026-YIL / AVGUST / 8-SON, I-QISM

ISSN: 2992-8982
https://yashil-iqtisodiyot-taraqqiyot.uz/

YASHIL

IQTISODIYOT&TARAQQIYOT

Ijtimoiy, iqtisodiy, texnologik, ilmiy, ommabop jurnal

Elektron nashr. 2026-yil, avgust.
I-qism

Bosh muharrir:
Sharipov Kongiratbay Avezimbetovich

Bosh muharrir o'rinbosari:
Karimov Norboy G'aniyevich

Muharrir:
Qurbonov Sherzod Ismatillayevich

YASHIL

IQTISODIYOT&TARAQQIYOT

Ijtimoiy, iqtisodiy, texnologik, ilmiy, ommabop jurnal

08.00.01 Iqtisodiyot nazariyasi
08.00.02 Makroiqtisodiyot
08.00.03 Sanoat iqtisodiyoti
08.00.04 Qishloq xo'jaligi iqtisodiyoti
08.00.05 Xizmat ko'rsatish tarmoqlari iqtisodiyoti
08.00.06 Ekonometrika va statistika
08.00.07 Moliya, pul muomalasi va kredit
08.00.08 Buxgalteriya hisobi, iqtisodiy tahlil va audit
08.00.09 Jahon iqtisodiyoti
08.00.10 Demografiya. Mehnat iqtisodiyoti
08.00.11 Marketing
08.00.12 Mintaqaviy iqtisodiyot
08.00.13 Menejment
08.00.14 Iqtisodiyotda axborot tizimlari va texnologiyalari
08.00.15 Tadbirkorlik va kichik biznes iqtisodiyoti
08.00.16 Raqamli iqtisodiyot va xalqaro raqamli integratsiya
08.00.17 Turizm va mehmonxona faoliyati

Muassis: "Ma'rifat-print-media" MChJ
Hamkorlarimiz: Toshkent davlat iqtisodiyot universiteti, O'zbekiston Respublikasi Bosh prokuraturasi huzuridagi Iqtisodiy jinoyatlarga qarshi kurashish departamenti

Jurnalning ilmiyligi:

""Yashil" iqtisodiyot va taraqqiyot" jurnali

O'zbekiston Respublikasi Oliy ta'lim, fan va innovatsiyalar vazirligi huzuridagi Oliy attestatsiya komissiyasi rayosatining 2023-yil 1-apreldagi 336/3-sonli qarori bilan ro'yxatdan o'tkazilgan.

MUNDARIJA

DEVELOPMENT MECHANISMS OF EMBEDDED FINANCE SERVICES IN COMMERCIAL BANKS OF UZBEKISTAN BASED ON OPEN BANKING

Khurramova Fotima Bakhodir qizi
Denau Institute of Entrepreneurship and Pedagogy
3rd-year student of the Banking and Auditing program
E-mail: fotimakhon005@gmail.com

Abstract. The rapid digital transformation of the banking sector has accelerated the development of innovative financial service models. In this context, Open Banking and Embedded Finance have become key instruments for improving the efficiency, accessibility, and competitiveness of commercial banks. The study aims to assess the development prospects of Embedded Finance services in the commercial banks of Uzbekistan based on Open Banking principles and to formulate practical recommendations for their implementation. The theoretical foundations of these concepts are examined, international experience is analyzed, and the opportunities and challenges associated with integrating innovative financial solutions into Uzbekistan's banking sector are evaluated. Comparative and systematic analysis methods are employed to identify effective approaches to digital banking development. Particular attention is given to strengthening cooperation among commercial banks, fintech companies, and digital platforms in order to develop customer-oriented financial ecosystems and expand the range of modern banking services.

Keywords: Open Banking, Embedded Finance, fintech ecosystem, digital transformation, commercial banks, open APIs, Banking-as-a-Service (BaaS), digital financial services, financial innovation, banking ecosystem.

Аннотация. Стремительная цифровая трансформация банковского сектора способствует развитию инновационных моделей предоставления финансовых услуг. В этих условиях технологии Open Banking и Embedded Finance становятся важными инструментами повышения эффективности, доступности и конкурентоспособности коммерческих банков. Цель исследования заключается в анализе перспектив развития услуг Embedded Finance в коммерческих банках Узбекистана на основе принципов Open Banking, а также в разработке практических рекомендаций по их внедрению. Рассматриваются теоретические основы данных концепций, анализируется международный опыт и оцениваются возможности и проблемы интеграции инновационных финансовых решений в банковский сектор Узбекистана. Для определения эффективных подходов к развитию цифрового банкинга применены методы сравнительного и системного анализа. Особое внимание уделено развитию сотрудничества между коммерческими банками, финтех-компаниями и цифровыми платформами в целях формирования клиентоориентированных финансовых экосистем и расширения спектра современных банковских услуг.

Ключевые слова: Open Banking, Embedded Finance, FinTech-экосистема, цифровая трансформация, коммерческие банки, открытые API, Banking-as-a-Service (BaaS), цифровые финансовые услуги, финансовые инновации, банковская экосистема.

INTRODUCTION

The rapid development of digital technologies has significantly transformed the global financial services market. Traditional banking models are gradually shifting toward digital ecosystem-based approaches due to increasing customer demand for fast, convenient, and personalized financial services, the expansion of fintech companies, and the development of platform-based business models. One of the major trends in the modern financial sector is the integration of banking services into digital platforms through the Open Banking and Embedded Finance models. Open Banking enables secure data exchange among banks, fintech companies, and third-party service providers through Application Programming Interface (API) technologies. Embedded Finance allows financial services to be directly integrated into digital platforms, such as e-commerce systems and mobile applications, thereby providing customers with seamless access to financial products and services.

The development of Embedded Finance is driven by the advancement of API technologies, growing consumer demand for digital services, regulatory support, and the expansion of ecosystem-based business models. International experience demonstrates that Open Banking-based Embedded Finance models strengthen cooperation among banks, fintech companies, and digital platforms, thereby contributing to the creation of innovative financial products and enhancing the efficiency of financial services.

In Uzbekistan, the digital transformation of the banking sector and the development of modern financial technologies have become important priorities of the country's economic reforms. The Presidential Decree of the Republic of Uzbekistan No. DP-6079[1], dated October 5, 2020, **"On Approval of the Strategy 'Digital Uzbekistan – 2030' and Measures for Its Effective Implementation,"** identifies the development of digital infrastructure, the introduction of digital technologies, and the expansion of electronic services as key priorities [1]. Furthermore, the Presidential Decree of the Republic of Uzbekistan No. DP-5992[2], dated May 12, 2020, **"On the Strategy for Reforming the Banking System of the Republic of Uzbekistan for 2020–2025,"** emphasizes accelerating the digital transformation of commercial banks, introducing innovative technologies, and improving modern banking services [2].

Currently, commercial banks in Uzbekistan are actively developing mobile banking, remote banking services, electronic payment systems, and fintech solutions. At the same time, the effective implementation of Embedded Finance services based on Open Banking principles requires the further development of bank–fintech cooperation mechanisms, API infrastructure, data security, and the regulatory framework. The Law of the Republic of Uzbekistan No. LRU–578[3], **"On Payments and Payment Systems,"** provides an important legal basis for the development of digital payment infrastructure and innovative financial services [3].

Despite the growing importance of digital financial ecosystems, the development mechanisms of Embedded Finance services based on Open Banking principles in Uzbekistan's commercial banking sector offer broad opportunities for further scientific research and practical application. Therefore, analyzing these mechanisms, examining international experience, and developing practical recommendations for their implementation constitute important scientific and practical objectives.

LITERATURE REVIEW

The acceleration of digital transformation processes has led to the emergence of new business models in the financial services market. In particular, the concepts of Open Banking and Embedded Finance have been widely studied in the scientific literature as important directions for the development of modern banking systems. Research in this field primarily focuses on the transition of banks from traditional closed service models to open digital ecosystem-based models, the integration of financial services through API technologies, and the development of cooperation mechanisms between banks and fintech companies.

Zachariadis and Ozcan analyzed the concept of Open Banking as a new financial ecosystem based on open API technologies. According to the authors, open APIs enable the integration of banking services with third-party service providers, thereby creating opportunities for the development of platform-based business models in the financial services market [4]. The researchers emphasize that Open Banking transforms the competitive environment of the banking sector, encourages innovation, and creates new opportunities for the development of financial services.

Gomber, Koch, and Siering examined the development of digital finance and fintech, noting that digitalization is fundamentally transforming the processes of providing financial services. According to their findings, fintech

1 Presidential Decree of the Republic of Uzbekistan No. DP-6079, dated October 5, 2020, "On Approval of the Strategy 'Digital Uzbekistan – 2030' and Measures for Its Effective Implementation,": https://lex.uz/docs/7008256

2 Presidential Decree of the Republic of Uzbekistan No. DP-5992, dated May 12, 2020, "On the Strategy for Reforming the Banking System of the Republic of Uzbekistan for 2020–2025,": https://lex.uz/en/docs/6972970

3 The Law of the Republic of Uzbekistan No. LRU–578, "On Payments and Payment Systems,": https://lex.uz/docs/-4575786

technologies, digital platforms, and emerging business models require financial institutions to reconsider their traditional approaches to service delivery and business development [5].

The role of regulatory and legal factors in the development of Open Banking has also been widely discussed in academic research. In particular, the Payment Services Directive 2 (PSD2), adopted by the European Union, represents an important regulatory framework aimed at ensuring secure access to payment account information, expanding the participation of third-party providers in financial markets, and promoting the development of open API infrastructures [6].

Research on the concept of Embedded Finance explains this model as the integration of financial services into non-financial digital platforms. According to this approach, payment services, lending, insurance, and other financial products are provided not through separate banking channels but directly within e-commerce platforms, mobile applications, and other digital ecosystems used by customers.

Stefanelli, Manta, and Toma analyzed the transformation of banks' roles in the context of digitalization and highlighted that the traditional role of banks as financial intermediaries is evolving. The authors demonstrated that banks are developing new service models through API technologies and cooperation with fintech companies, thereby becoming active participants in digital financial ecosystems [7].

Studies on API-based integration mechanisms identify APIs as a key technological infrastructure that enables secure data exchange between banks and external digital platforms. Through API technologies, banks can establish cooperation with fintech companies, accelerate the development of innovative financial products, and provide customers with more personalized financial services [8].

Thus, the analysis of the existing scientific literature demonstrates that extensive international research has been conducted on Open Banking, fintech, and digital banking services. At the same time, the development mechanisms of Embedded Finance services based on Open Banking principles in the context of commercial banks in Uzbekistan provide broad opportunities for further scientific research. In particular, issues related to bank–fintech cooperation models, the application of API infrastructure, and the development of organizational and economic mechanisms adapted to the national banking system offer promising directions for future scientific investigation. These research opportunities further confirm the relevance of the present study.

RESEARCH METHODOLOGY

This study employs systematic analysis, comparative analysis, scientific abstraction, and generalization methods to examine the mechanisms for developing Embedded Finance services based on Open Banking principles in the commercial banks of Uzbekistan. The theoretical foundation of the research is based on the scientific works of domestic and foreign scholars in the fields of Open Banking, Embedded Finance, fintech ecosystems, and the digital transformation of the banking system.

During the research process, the development experience of Open Banking and Embedded Finance models in developed countries and the possibilities for their application in the banking system of Uzbekistan were analyzed using a comparative approach. In addition, cooperation mechanisms between banks and fintech companies, opportunities for the application of API technologies, and the factors influencing the development of digital financial ecosystems were examined. Based on the findings obtained, scientific conclusions and practical recommendations were formulated to support the development of Embedded Finance services based on Open Banking principles in the commercial banks of Uzbekistan.

ANALYSIS AND RESULTS

The analysis of international experience plays an important role in identifying effective mechanisms for developing Open Banking-based Embedded Finance services. The experience of developed countries demonstrates that the successful implementation of these models depends on an advanced open API infrastructure, an effective regulatory framework, and strong cooperation between banks and fintech companies. Therefore, the experiences of the United Kingdom, the European Union, the United States, and Singapore were analyzed within the framework of this study (Table 1).

Table 1. International experience in developing Open Banking and Embedded Finance services and its relevance for commercial banks in Uzbekistan[4]

No.	Country	Implementation of Open Banking and Embedded Finance Services	Relevance for Commercial Banks in Uzbekistan
1	**United Kingdom**	The United Kingdom is one of the leading countries in the development of the Open Banking model. Since **2018**, open API standards have been implemented within the framework of Open Banking initiatives. This model has enabled secure data exchange and strengthened cooperation among banks, fintech companies, and third-party service providers. As a result, opportunities for digital payments, personal financial management tools, and integrated financial services have significantly expanded.	The experience of the United Kingdom is valuable for the commercial banks of Uzbekistan in developing open API infrastructure, strengthening cooperation with fintech companies, and providing customers with integrated digital financial services.
2	**European Union**	In the European Union, the Payment Services Directive 2 (PSD2) established mechanisms for secure access to customers' bank account information with their consent and enabled the provision of payment services through third-party providers. This approach contributed to the development of open API infrastructure, the expansion of fintech activities, and the integration of banking services into digital platforms.	The PSD2 experience provides an important foundation for developing the legal framework for Open Banking in Uzbekistan, ensuring customer data protection, implementing secure data exchange standards, and supporting the further development of the fintech market.
3	**United States**	In the United States, Open Banking approaches have primarily evolved through market-based mechanisms, fintech companies, API providers, and Banking-as-a-Service (BaaS) models. The integration of financial services into e-commerce platforms, mobile applications, and other digital ecosystems has contributed to the expansion of Embedded Finance solutions.	The experience of the United States is valuable for the commercial banks of Uzbekistan in developing strategic partnerships with fintech companies, expanding API-based services, implementing Banking-as-a-Service (BaaS) models, and creating innovative digital business models.
4	**Singapore**	Singapore has implemented a consistent policy aimed at developing an open financial ecosystem through cooperation between government institutions and financial organizations. The application of API technologies, digital identification systems, and innovative payment infrastructure has expanded opportunities for integrating financial services into digital platforms.	Singapore's experience can be effectively applied in Uzbekistan to develop digital identification systems, establish secure data exchange mechanisms, improve innovative payment infrastructure, and strengthen the bank–fintech ecosystem.

The analysis of Table 1 indicates that the successful development of Open Banking and Embedded Finance services is primarily determined by three key factors: a well-developed API infrastructure, an effective regulatory framework, and strong cooperation between banks and fintech companies. The experiences of the United Kingdom and the European Union demonstrate the importance of regulatory support and secure data exchange mechanisms, while the experience of the United States highlights the role of market-driven innovation and Banking-as-a-Service (BaaS) models. Singapore's experience emphasizes the significance of digital identification systems and advanced technological infrastructure. These approaches provide valuable opportunities for adaptation to the conditions of Uzbekistan's banking sector in order to enhance digital financial services and support the development of innovative business models (Figure 1).

4 Note: Compiled by the author based on data from international regulatory documents, academic studies, and analytical reports on Open Banking and Embedded Finance.

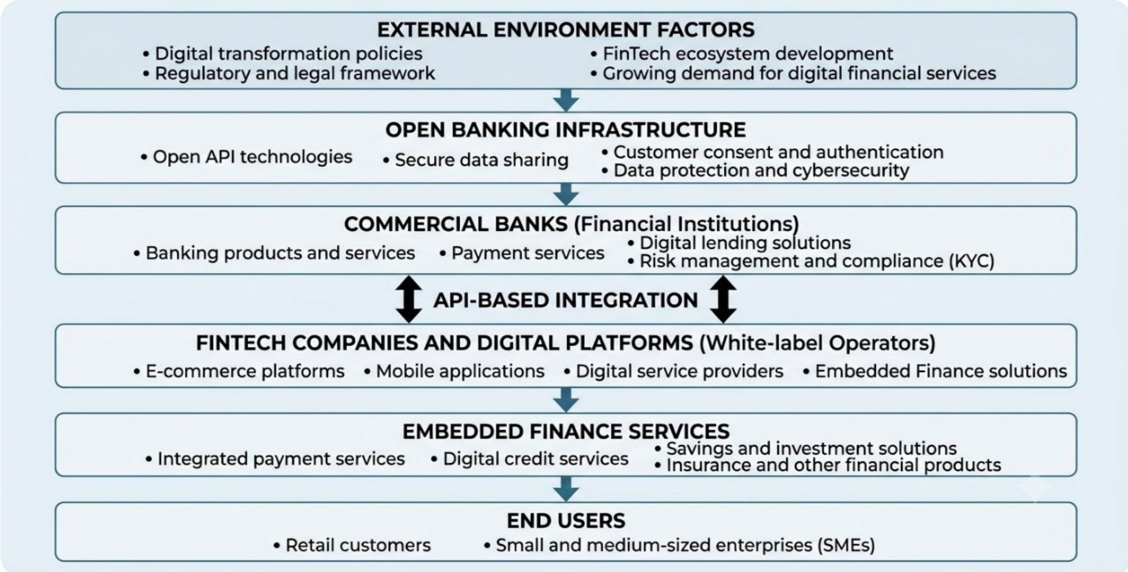

Figure 1. Conceptual model of developing Embedded Finance services based on Open Banking principles[5]

The conceptual model presented in **Figure 1** illustrates the mechanism for developing Embedded Finance services based on Open Banking principles. The model demonstrates that the development of Embedded Finance depends on the interaction among external environmental factors, Open Banking infrastructure, commercial banks, fintech companies, and digital platforms. Open API technologies serve as a key integration tool, enabling secure data exchange between banks and third-party service providers. Through this mechanism, financial services such as payments, digital lending, and investment solutions can be embedded into digital platforms and delivered directly to end users (Table 2).

Table 2. Key Factors Influencing the Development of Open Banking-Based Embedded Finance Services in Uzbekistan[6]

No.	Factors	Description	Role in Developing Embedded Finance Services
1	Digital infrastructure	The development of modern IT infrastructure, open API technologies, cloud solutions, and reliable digital platforms is essential for implementing Open Banking services.	Digital infrastructure enables the integration of banking services with e-commerce platforms, mobile applications, and other digital ecosystems.
2	FinTech ecosystem development	Cooperation between banks and fintech companies, the development of innovative financial technologies, and the creation of new business models play an important role in expanding digital financial services.	FinTech companies facilitate the integration of banking products into digital platforms and support the development of Embedded Payments, Embedded Lending, and other financial services.
3	Regulatory and legal framework	Effective regulatory mechanisms are required to govern customer data access, third-party service providers, and the security of digital financial services.	A well-developed regulatory framework ensures secure cooperation between banks and digital platforms and supports the reliable operation of Embedded Finance services.
4	Data security and cybersecurity	The implementation of strong authentication methods, data encryption, and cybersecurity mechanisms is essential to ensure secure information exchange.	Data security enhances customer trust and enables the secure exchange of financial information within Embedded Finance ecosystems.
5	Customer consent and trust	Under the Open Banking model, customers provide consent for sharing their financial data with third-party providers and demonstrate confidence in digital financial services.	Customer consent enables the delivery of personalized financial services through various digital platforms and enhances the overall user experience.
6	Financial and digital literacy	Increasing public awareness and improving skills related to digital payments, mobile banking, and modern financial services are essential.	Higher levels of financial and digital literacy increase demand for Embedded Finance services and support their effective adoption by users.

5 Note: Developed by the author based on the analysis of Open Banking and Embedded Finance concepts, international experience, and digital transformation trends in the banking sector.
6 Note: Developed by the author.

The analysis of **Table 2** indicates that the successful development of Open Banking-based Embedded Finance services in Uzbekistan depends on several interrelated factors. Among these, digital infrastructure, the development of the fintech ecosystem, and an effective regulatory framework play a decisive role in ensuring the integration of banking services with digital platforms. At the same time, data security, customer trust, and financial and digital literacy are essential for increasing the adoption and long-term sustainability of Embedded Finance services. Therefore, the coordinated development of these factors will contribute to the expansion of innovative financial services and further enhance the competitiveness of commercial banks in Uzbekistan.

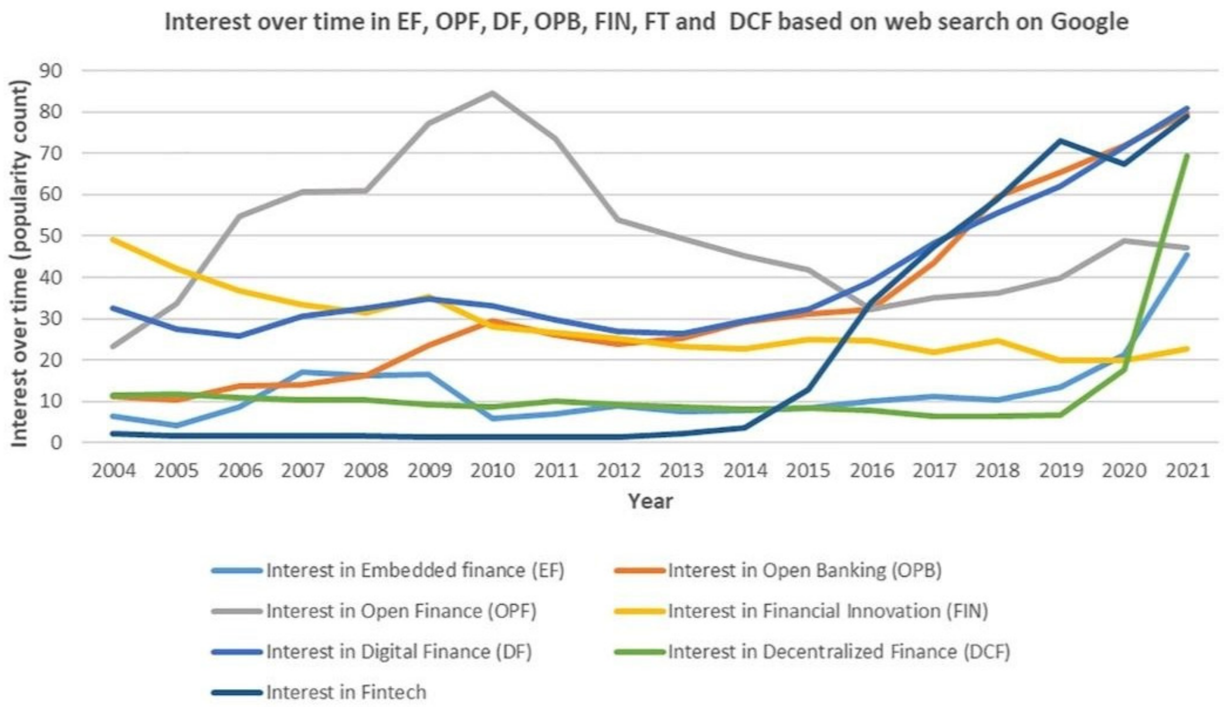

Figure 2. Global search interest trends for key digital finance concepts (2004–2021)[9][7]

The data presented in **Figure 2** illustrate the global evolution of public interest in key digital finance concepts. The results indicate a significant structural shift in financial research and digital finance trends. While generic concepts such as **Financial Innovation** have shown a gradual decline in search interest since **2004**, concept-specific terms such as **Open Banking (OPB)** and **FinTech (FT)** have experienced rapid growth beginning in **2015**. Furthermore, **Embedded Finance (EF)** and **Decentralized Finance (DeFi/DCF)** have emerged as major areas of interest since **2019**, reflecting the accelerating digital transformation of financial services and their integration into non-financial digital platforms worldwide.

Table 3. Proposed mechanisms for developing Open Banking-based Embedded Finance services in commercial banks of Uzbekistan[8]

Mechanism	Proposed Measures	Expected Outcome
API infrastructure	Develop standardized open APIs.	Secure integration with fintech platforms.
Bank–FinTech cooperation	Establish partnership models and implement Banking-as-a-Service (BaaS).	Expansion of innovative financial services.
Regulatory framework	Adopt Open Banking regulations and supporting legal standards.	Improved legal certainty and stronger customer protection.
Data security	Strengthen cybersecurity measures and customer consent mechanisms.	Increased customer trust and secure data sharing.
Digital literacy	Promote financial and digital education programs.	Higher adoption of Embedded Finance services.

7 Developed by the author
8 Note: Developed by the author.

The proposed mechanisms presented in **Table 3** demonstrate that the successful development of Open Banking-based Embedded Finance services in Uzbekistan requires a comprehensive and coordinated approach. Strengthening API infrastructure, promoting bank–FinTech cooperation, improving the regulatory framework, ensuring data security, and enhancing financial and digital literacy will contribute to expanding innovative financial services and further improving the competitiveness of commercial banks in Uzbekistan.

CONCLUSION AND RECOMMENDATIONS

This study demonstrates that commercial banks in Uzbekistan are gradually transitioning from traditional, isolated business models to integrated digital financial ecosystems. The global development of Open Banking (OPB) and Embedded Finance (EF) reflects the growing demand for seamless and customer-oriented digital financial interactions. Supported by more than 40 million remote banking users and the rapid development of the fintech sector, Uzbekistan has a strong foundation for expanding Embedded Finance services. At the same time, further development can be supported through the introduction of unified Open API standards, the enhancement of data security and customer consent mechanisms, and the continued modernization of technological infrastructure across commercial banks.

Recommendations

Regulate Open API Standards. The Central Bank is encouraged to introduce standardized Open API protocols aligned with PSD2 principles to ensure secure, reliable, and standardized data exchange between banks and fintech companies.

Promote Banking-as-a-Service (BaaS) Business Models. Commercial banks are encouraged to further develop Banking-as-a-Service (BaaS) platforms by modularizing their infrastructure, thereby expanding opportunities to provide financial services through e-commerce platforms and merchant applications.

Enhance Data Security and Customer Consent. The implementation of automated customer consent management systems and comprehensive end-to-end encryption frameworks will further strengthen the protection of customer data and increase confidence in digital financial services.

Expand Embedded SME Financial Services. Commercial banks are encouraged to expand embedded trade finance solutions and automated credit-scoring tools within B2B merchant platforms, thereby improving access to corporate financing and supporting the development of the business sector.

REFERENCES

1. Decree of the President of the Republic of Uzbekistan. On Approval of the Strategy “Digital Uzbekistan – 2030” and Measures for Its Effective Implementation: No. DP–6079, October 5, 2020.: https://lex.uz/ru/docs/7008256
2. Decree of the President of the Republic of Uzbekistan. On the Strategy for Reforming the Banking System of the Republic of Uzbekistan for 2020–2025: No. DP–5992, May 12, 2020.: https://lex.uz/en/docs/6972970
3. Law of the Republic of Uzbekistan. On Payments and Payment Systems: No. LRU–578, November 1, 2019.: https://lex.uz/ru/docs/4575788
4. Zachariadis, M., & Ozcan, P. The API Economy and Digital Transformation in Financial Services: The Case of Open Banking // *SWIFT Institute Working Paper*. – 2017. – No. 2016–001.
5. Gomber, P., Koch, J. A., & Siering, M. Digital Finance and FinTech: Current Research and Future Research Directions // *Journal of Business Economics*. – 2017. – Vol. 87. – P. 537–580.
6. European Parliament and Council. Directive (EU) 2015/2366 on Payment Services in the Internal Market (PSD2). – Brussels, 2015.
7. Stefanelli, V., Manta, F., & Toma, P. Digital Financial Services and Open Banking Innovation: Are Banks Becoming Invisible? – 2022.
8. Fett, D., Hosseyni, P., & Küsters, R. An Extensive Formal Security Analysis of the OpenID Financial-grade API. – 2019.
9. Ozili, P. K. Embedded Finance: Assessing the Benefits, Use Case, Challenges and Interest over Time // *Journal of Internet and Digital Economics*. – 2022. – Vol. 2, No. 1. – P. 34–48.

YASHIL

IQTISODIYOT&TARAQQIYOT

Ijtimoiy, iqtisodiy, texnologik, ilmiy, ommabop jurnal

Ingliz tili muharriri: Feruz HAKIMOV

Musahhih: Zokir ALIBEKOV

Sahifalovchi va dizayner: Hasan MAQSUDOV

2026. № 8/1

Mazkur jurnalda maqolalar chop etish uchun quyidagi havolalarga
maqola, reklama, hikoya va boshqa ijodiy materiallar yuborishingiz mumkin.
Materiallar va reklamalar pullik asosda chop etiladi.
El.Pochta: sq143235@gmail.com
Bot: @iqtisodiyot_77
Tel.: 93 718 40 07

Jurnalga istalgan payt quyidagi rekvizitlar orqali obuna bo‘lishingiz mumkin. Obuna bo‘lgach, @iqtisodiyot_77 telegram sahifamizga to‘lov haqidagi ma’lumotni skrinshot yoki foto shaklida jo‘natishingizni so‘raymiz. Shu asosda har oygi jurnal yangi sonini manzilingizga jo‘natamiz.

““Yashil” iqtisodiyot va taraqqiyot” jurnali 03.11.2022-yildan
O‘zbekiston Respublikasi Prezidenti Adminstratsiyasi huzuridagi
Axborot va ommaviy kommunikatsiyalar agentligi tomonidan
№566955 reyestr raqami tartibi bo‘yicha ro‘yxatdan o‘tkazilgan.
Litsenziya raqami: №046523. PNFL: 30407832680027

Manzilimiz: Toshkent shahar, Mirzo Ulug‘bek tumani
Kumushkon ko‘chasi, 26-uy.

Jurnal sayti: https://yashil-iqtisodiyot-taraqqiyot.uz